Photonic Crystals for Far-Infrared Wavelength Quantum Cascade Lasers

[1]L. A. Dunbar, [1]V. Moreau, [1]B. Lombardet, [2]R. Ferrini, [1]R. Houdré, [3]Lorenzo Sirigu, [3]Giacomo Scalari, [3]Marcella Giovannini and [3]Jérôme Faist
[1]Institut de Photonique et d'Electronique Quantique, [2]Lab. of Optoelectronics of Molecular Materials, Ecole Polytechnique Fédérale de Lausanne, CH-1015 Lausanne, Switzerland
[3]Physique Mésoscopique, Institut de Physique,
Université de Neuchâtel, CH-2000 Neuchâtel, Switzerland

At far-infrared (FIR) wavelengths versatile light guiding solutions still need to be improved upon despite the numerous applications to which these wavelengths lend themselves. Photonic Crystals (PhC) are an ideal candidate to fulfil this role. Moreover, the corresponding dimension of the periodicity of the PhC lattice scales according to the wavelength for which the PhCs are designed. Thus, fabrication is easier at the FIR wavelengths than the near-infrared telecommunication wavelengths.

Two GaAs-based PhC-Quantum Cascade Lasers (QCLs) were fabricated using two different technologies. One in which the PhC periodicity is obtained by Cl_2-based reactive ion etching (RIE) of pillars into a QCL, this is the classically preferred structure as the bandgap is greater for pillars than it is for holes in the emission direction of the QCLs, i.e. the TM direction. The second method uses a wet etch to obtain a series of holes in a perforated metal waveguide. The emission spectra of these two PhC-QCLs will be compared and a brief explanation for their differences will be given.